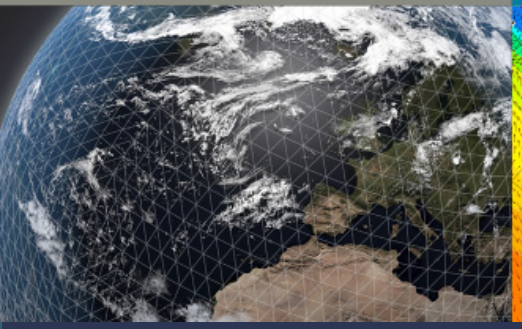
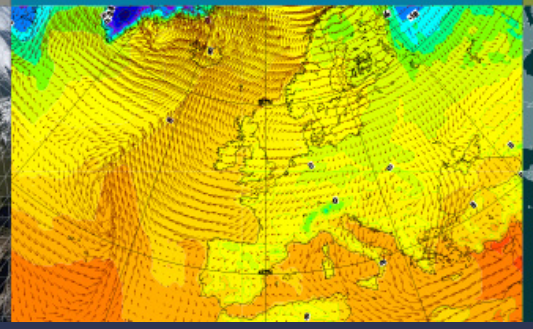
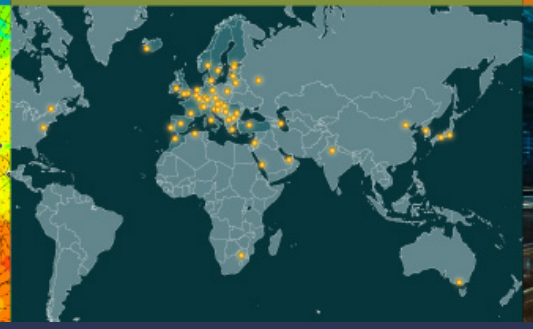
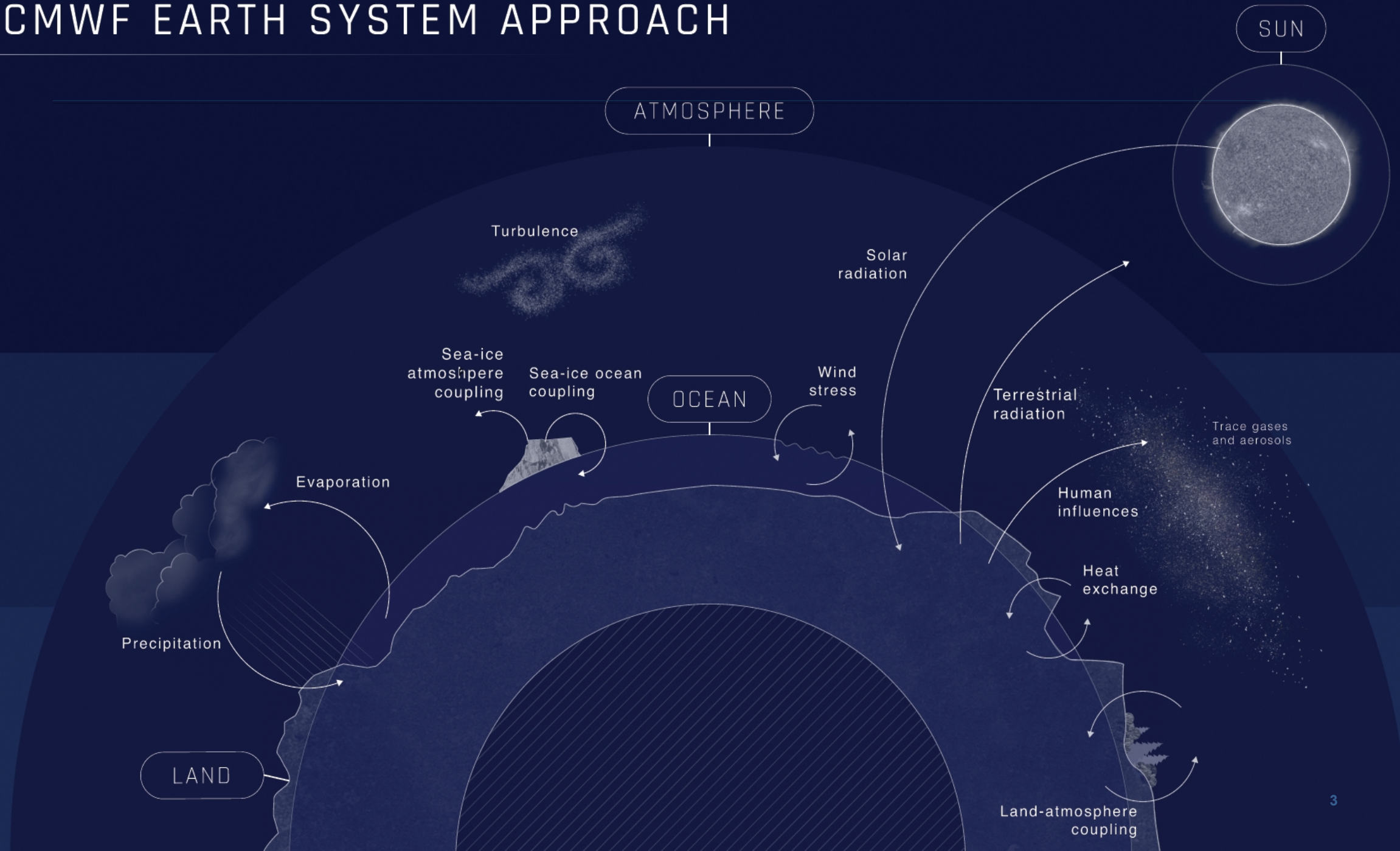
ECMWF’s activities and plans

NWP SCIENCE | GLOBAL FORECASTS | SERVING METEOROLOGY | SUPERCOMPUTING | ENVIRONMENTAL SERVICES

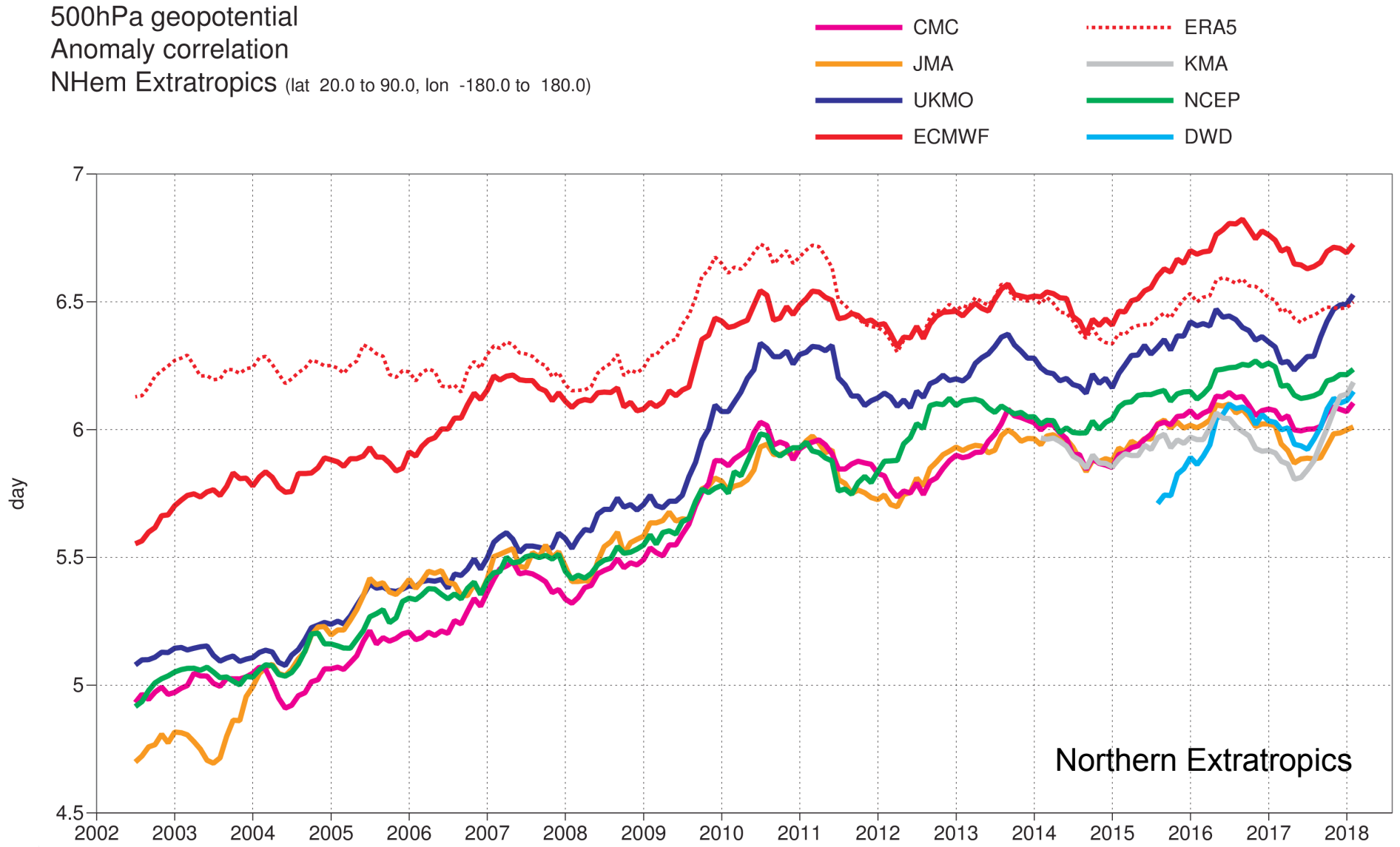




Delivering global predictions

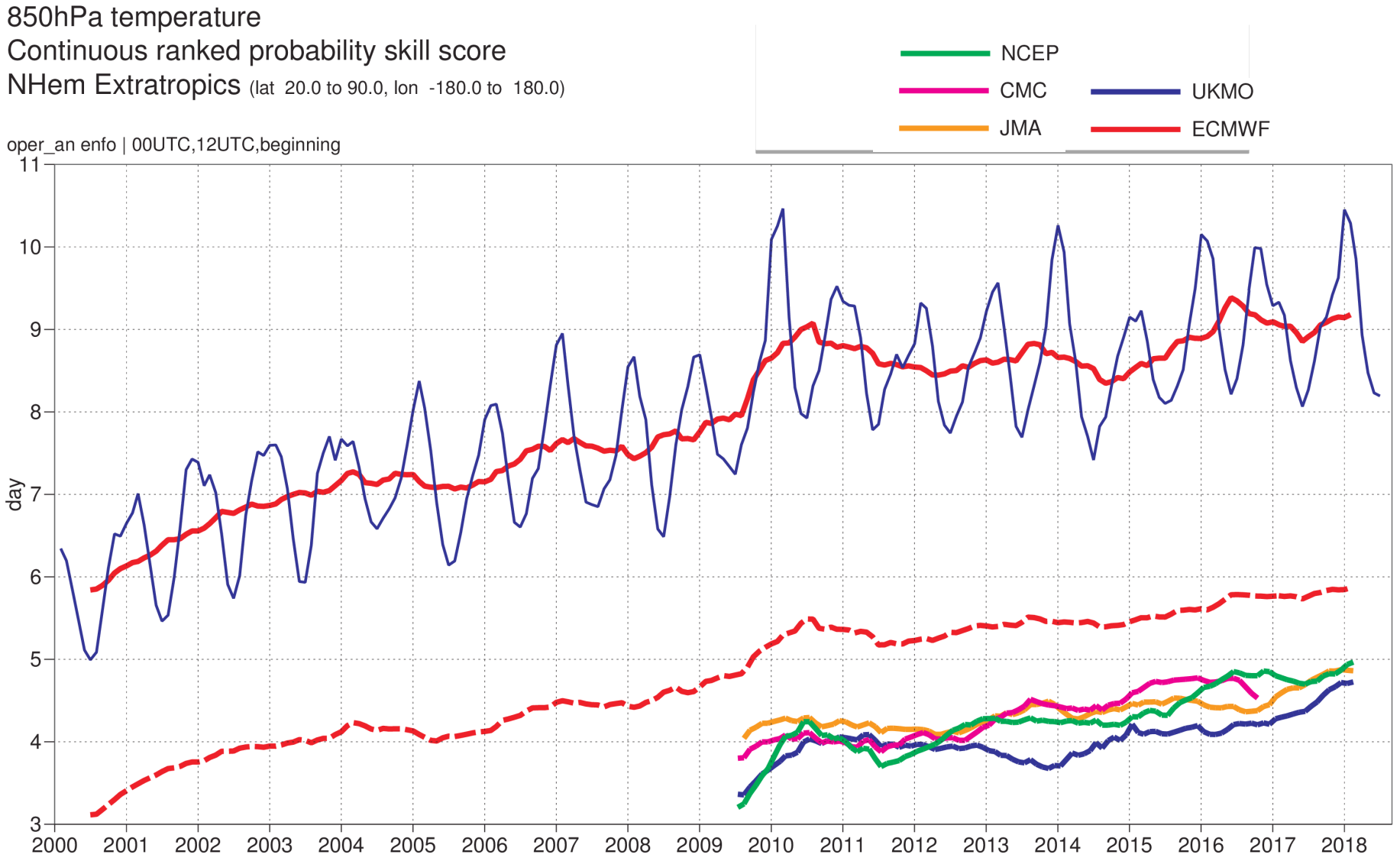
ECMWF EARTH SYSTEM APPROACH



Anomaly correlation of 500 hPa geopotential reaching 80%



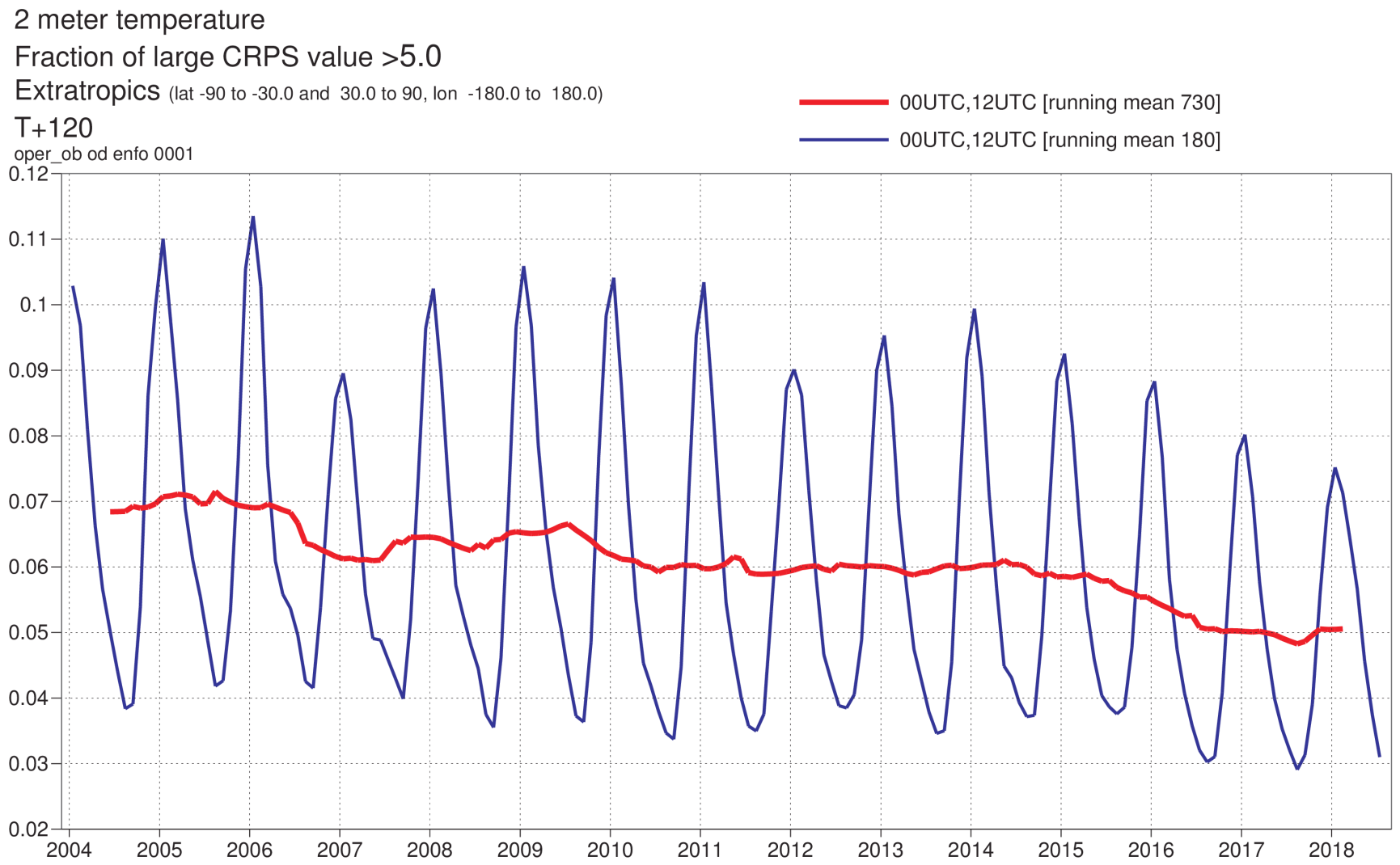
T850 hPa ENS performance



CRPSS=25%

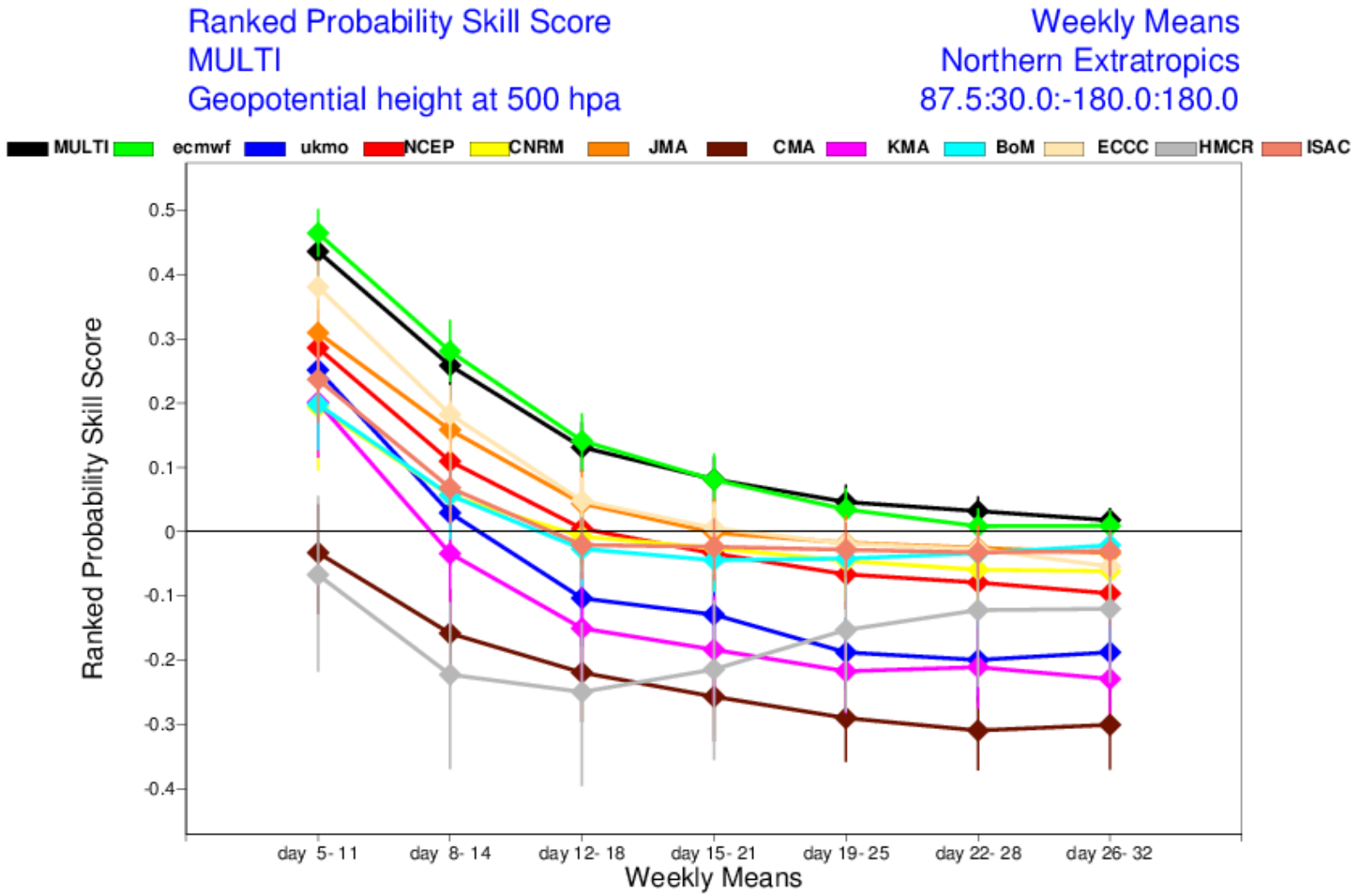
CRPSS=50%

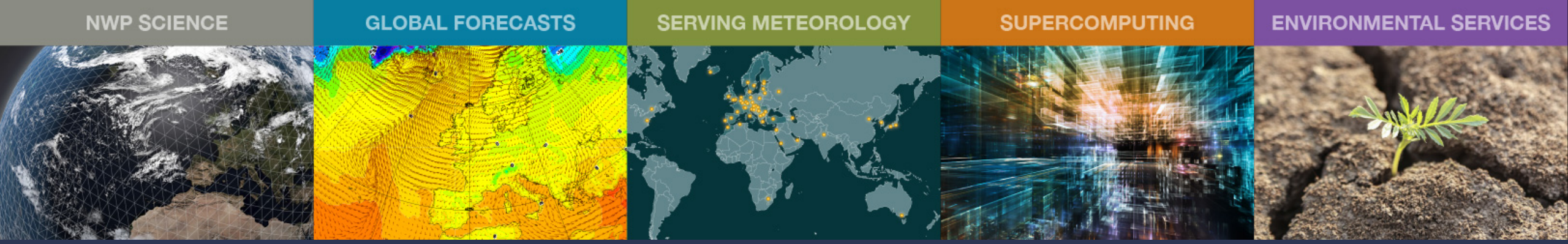
Fraction of large T2M errors - ENS



ECMWF

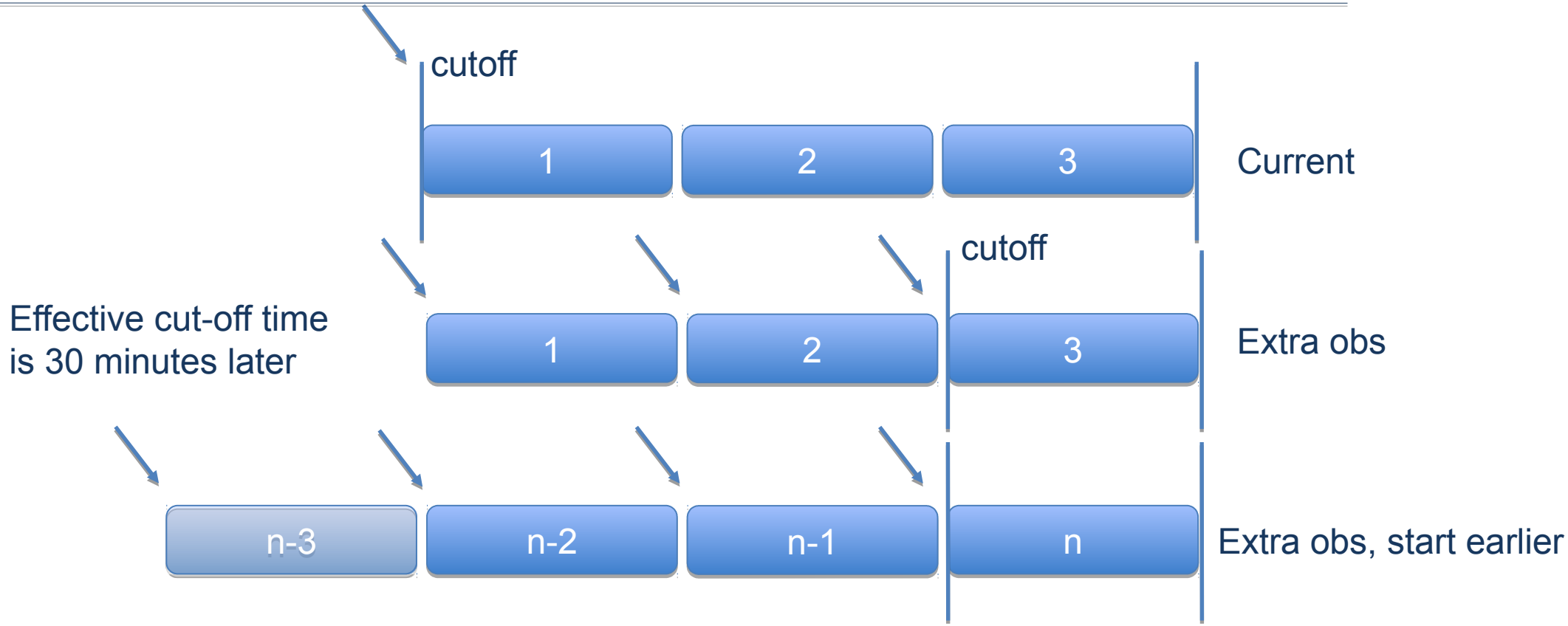
Collaborations and serving community: S2S project





Advancing weather science

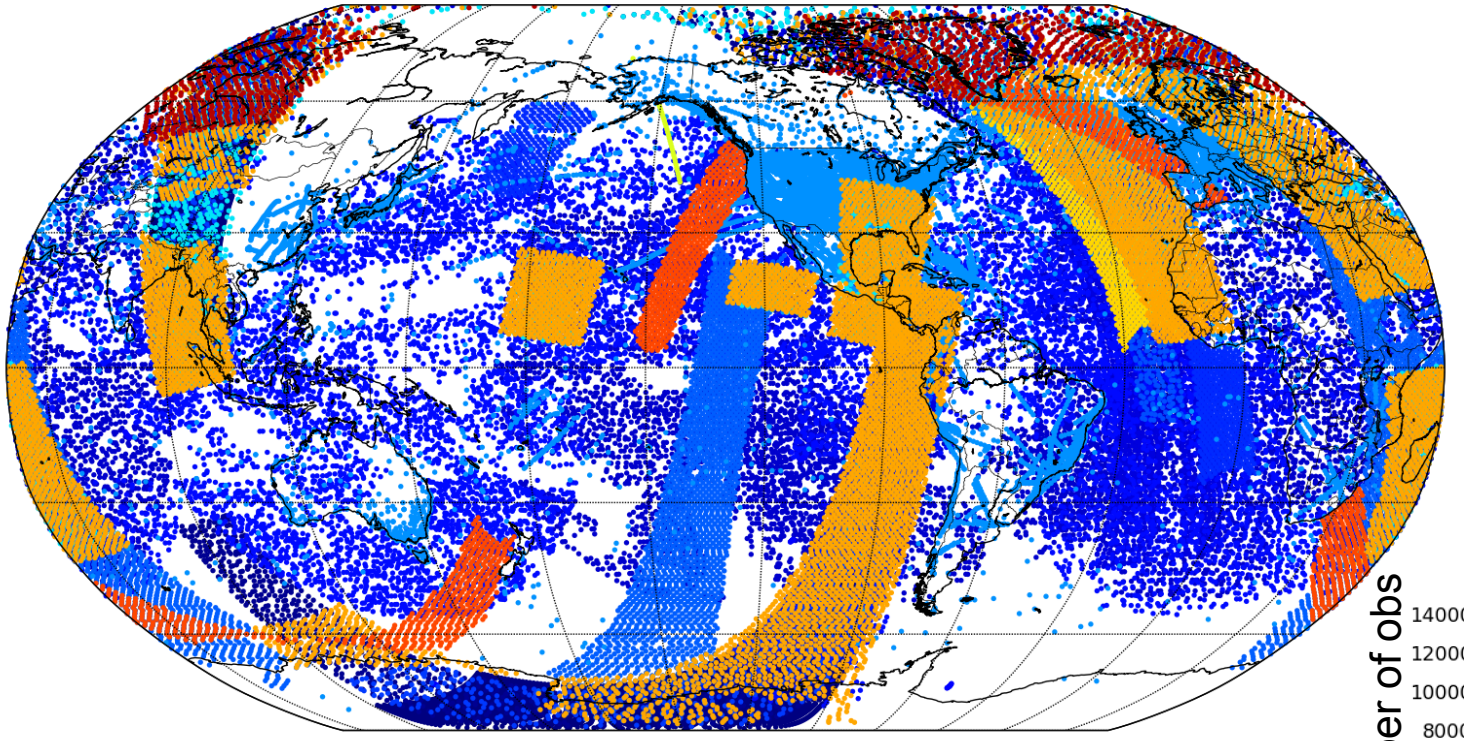
Continuous data assimilation

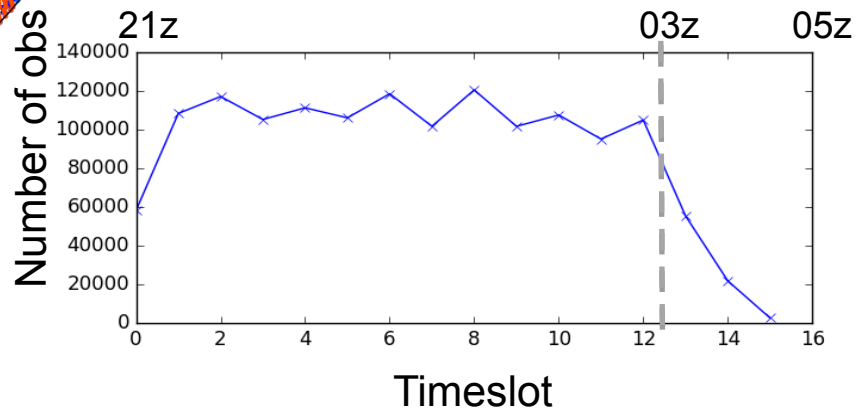


- Key point: Start running data assimilation **before** all of the observations have arrived
  - Most of the assimilation is removed from the time critical path
  - Configurations which were previously unaffordable can now be considered.

- Opens the possibility of a fully continuous assimilation system.

Extra observations assimilated in Continuous DA configuration

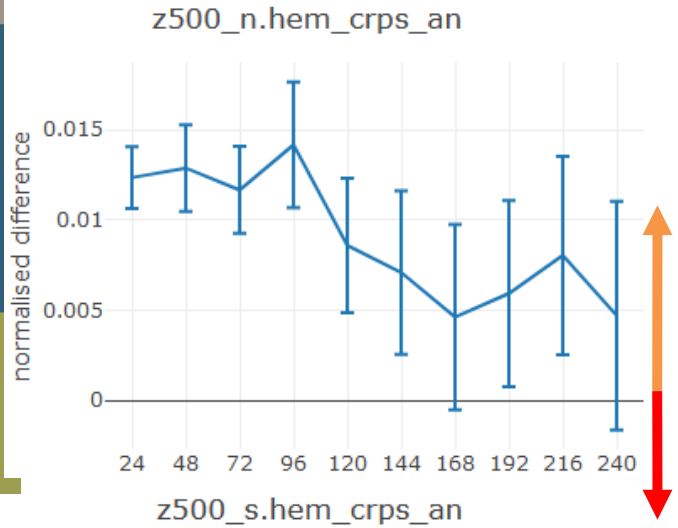


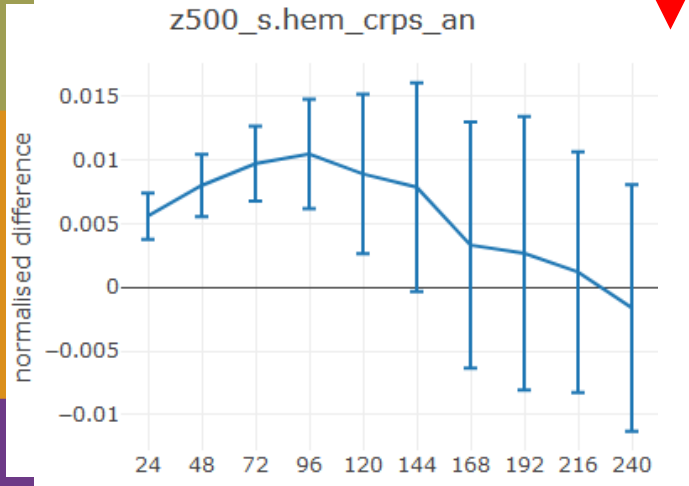


Impact of 1 hourly radiation on ENS

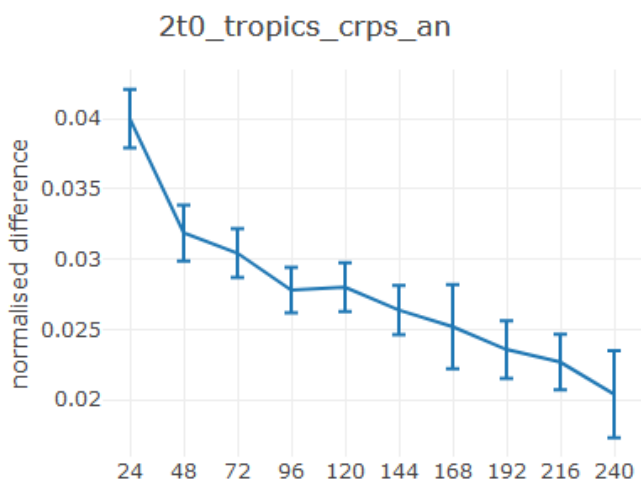
Experiments: TCo639, 50 members, 91 levels, June-August, 44 inidates

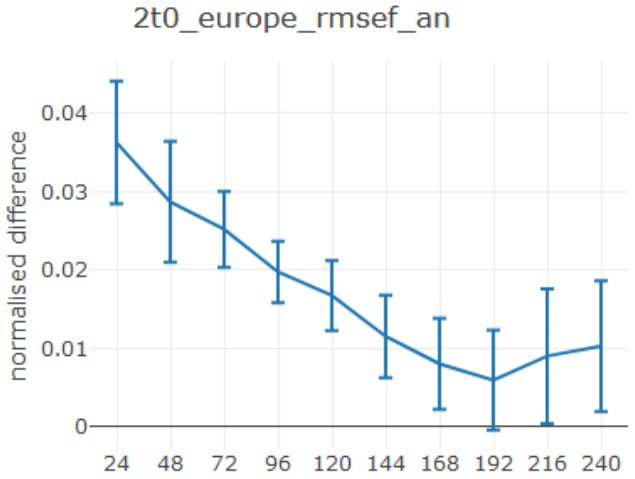
z500 CRPS

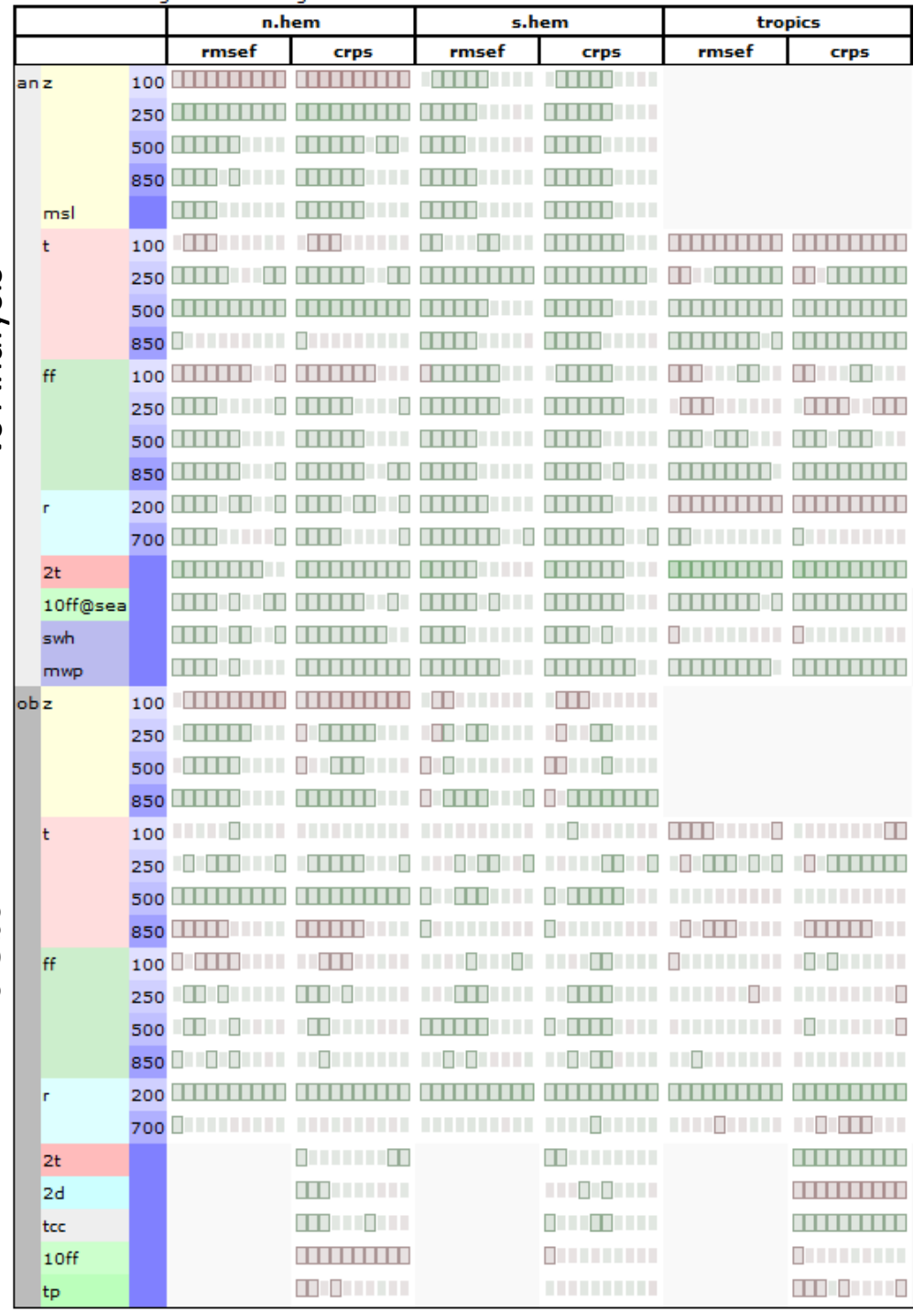




2t CRPS



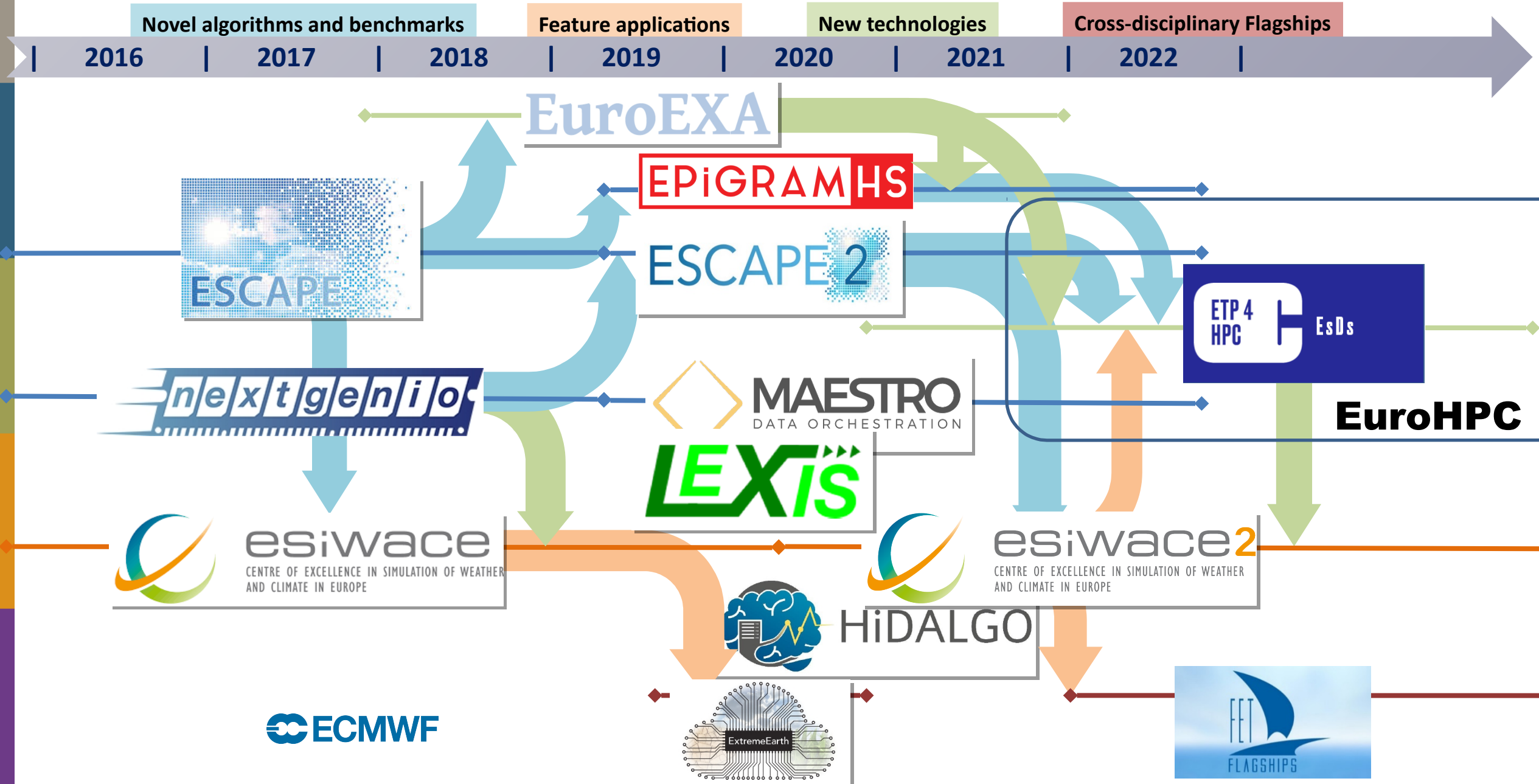




- clear improvement in scores! 3% cost increase (~ 2 minutes runtime)
- additional benefit: consistency with HRES, good for future development

ECMWF

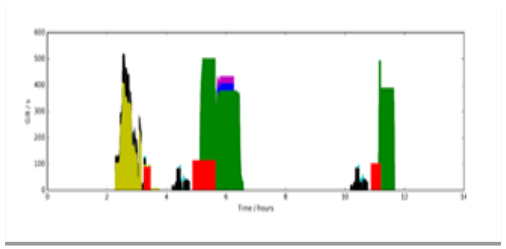
Scalability: ECMWF computing and data roadmap in H2020



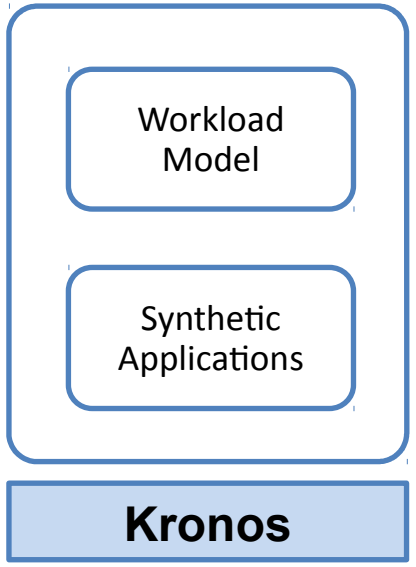
Funded by the
European Union

Kronos workload simulator as a HPC benchmark

- **Kronos tests HPC systems by deploying realistic workloads:**
  1. a workload model is generated from **HPC workload profiling data**
  2. the workload model is then translated (and scaled) into a **schedule of representative and easily-portable applications**
  3. Kronos models and tests **Compute, Interconnect, I/O subsystems**



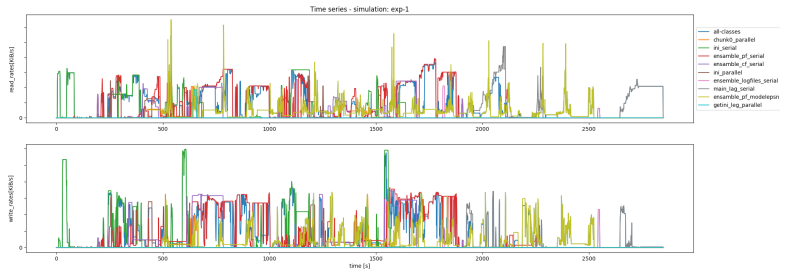
HPC Workload profiles



HPC prototype to be tested

Post-processing

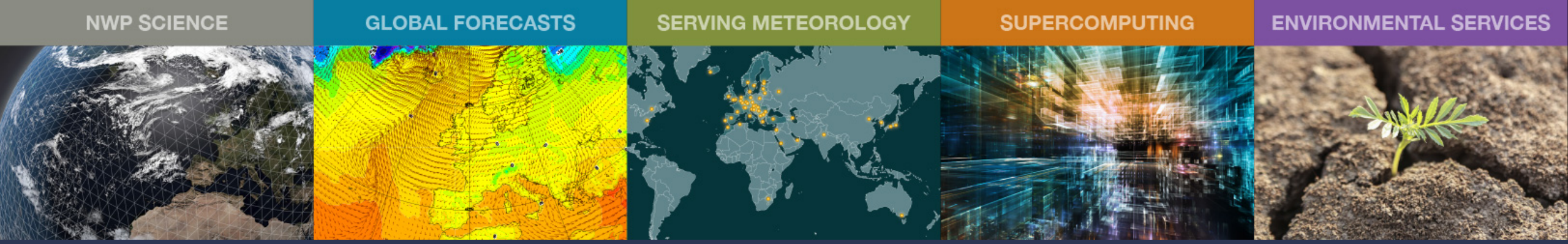
E.g. Workload execution profiles



E.g. I/O time-profiles

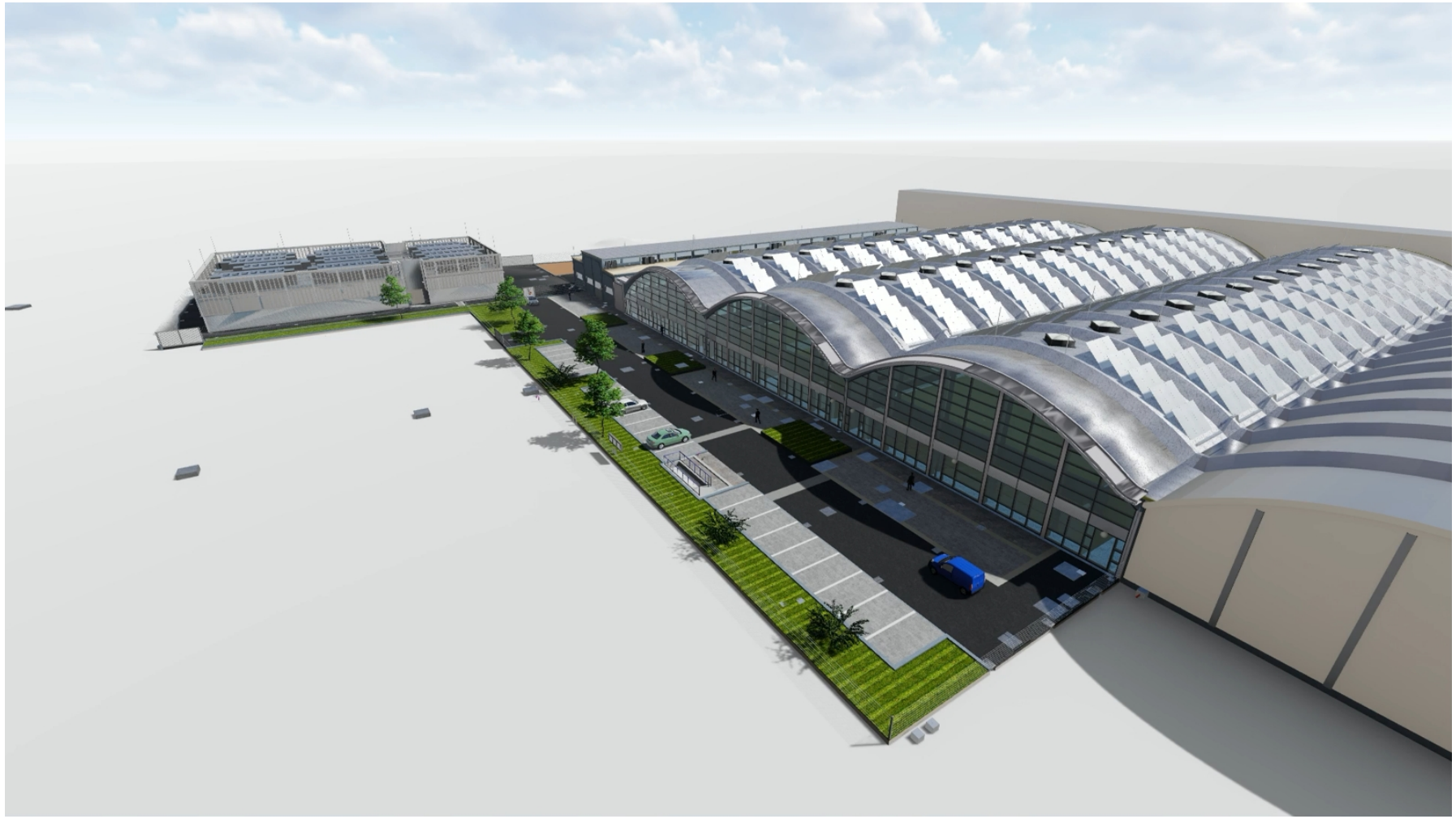
ECMWF

[Antonino Bonanni, Tiago Quintino]

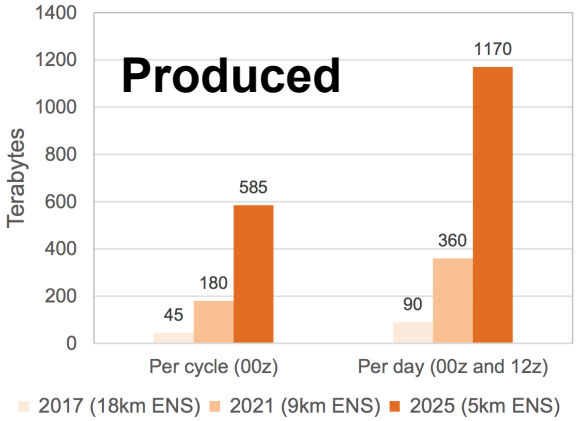


Sustaining HPC and Big Data

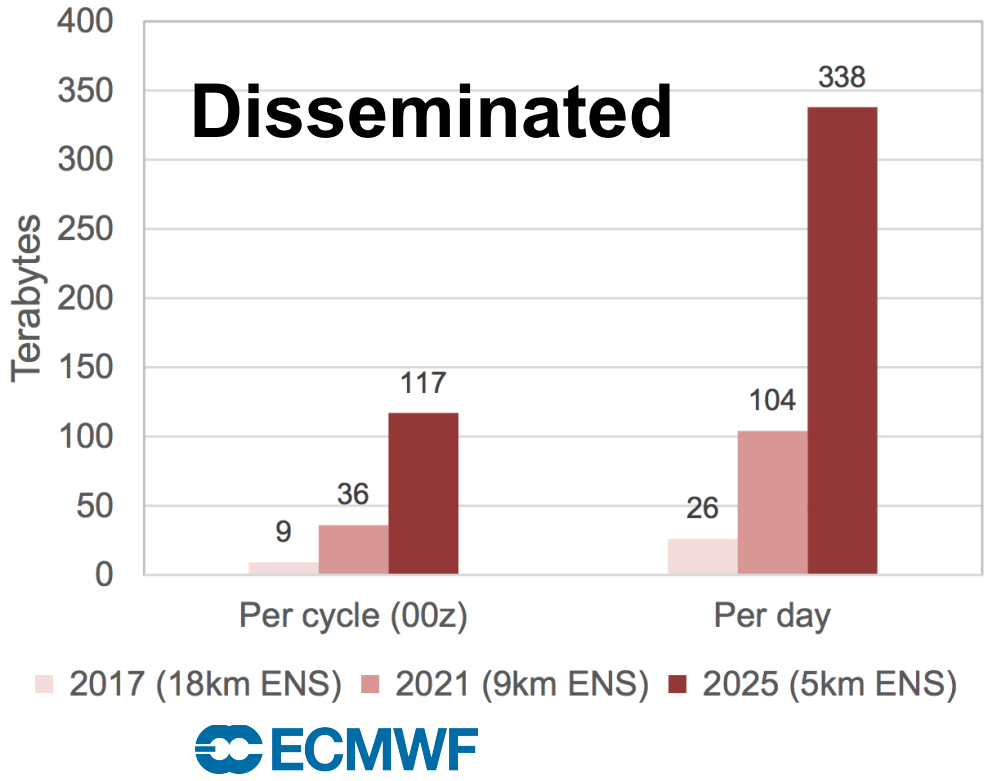
Our Future Datacentre – Bologna, Italy



BIG DATA - CONTEXT



ECMWF outputs are constantly increasing and a gap already exists



ECMWF

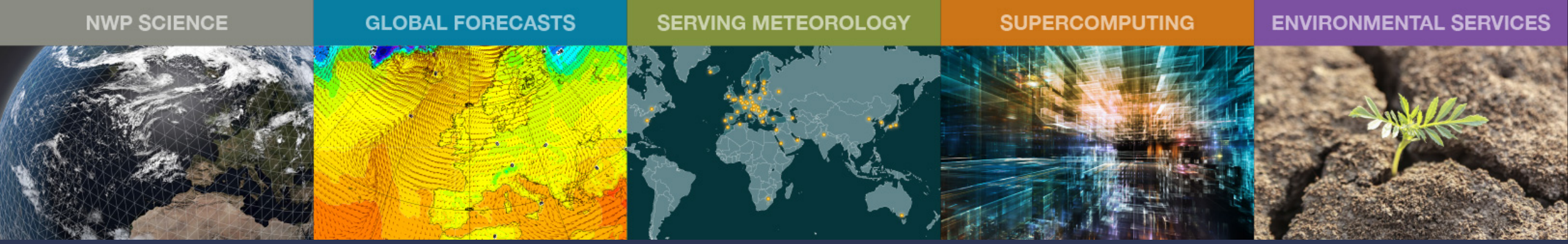
Cloud Computing Virtual Workshop, 31 August (60+ participants)

Compelling use cases across the EMI

ESTABLISHING THE EUROPEAN WEATHER CLOUD (EWC)

ECMWF + EUMETSAT

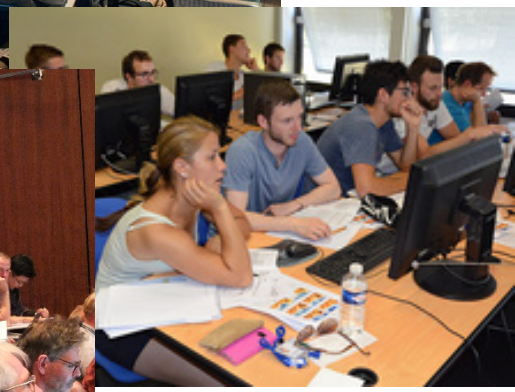
- converge discussions started in the context of ECMWF and EUMETSAT respective committees, but also taking place at EUMETNET, ECOMET and ICWED
- consider the risks, limitations and threats of relying fully on commercial Cloud Computing providers for ensuring some of our most crucial functions
- **propose a Cloud Computing-based infrastructure, focused on the needs of the meteorological community and building on the expertise and meteorological data owned by the two organisations**
- enable any entity of the EMI to join the infrastructure
- build on the experience gained by E & E in Cloud Computing

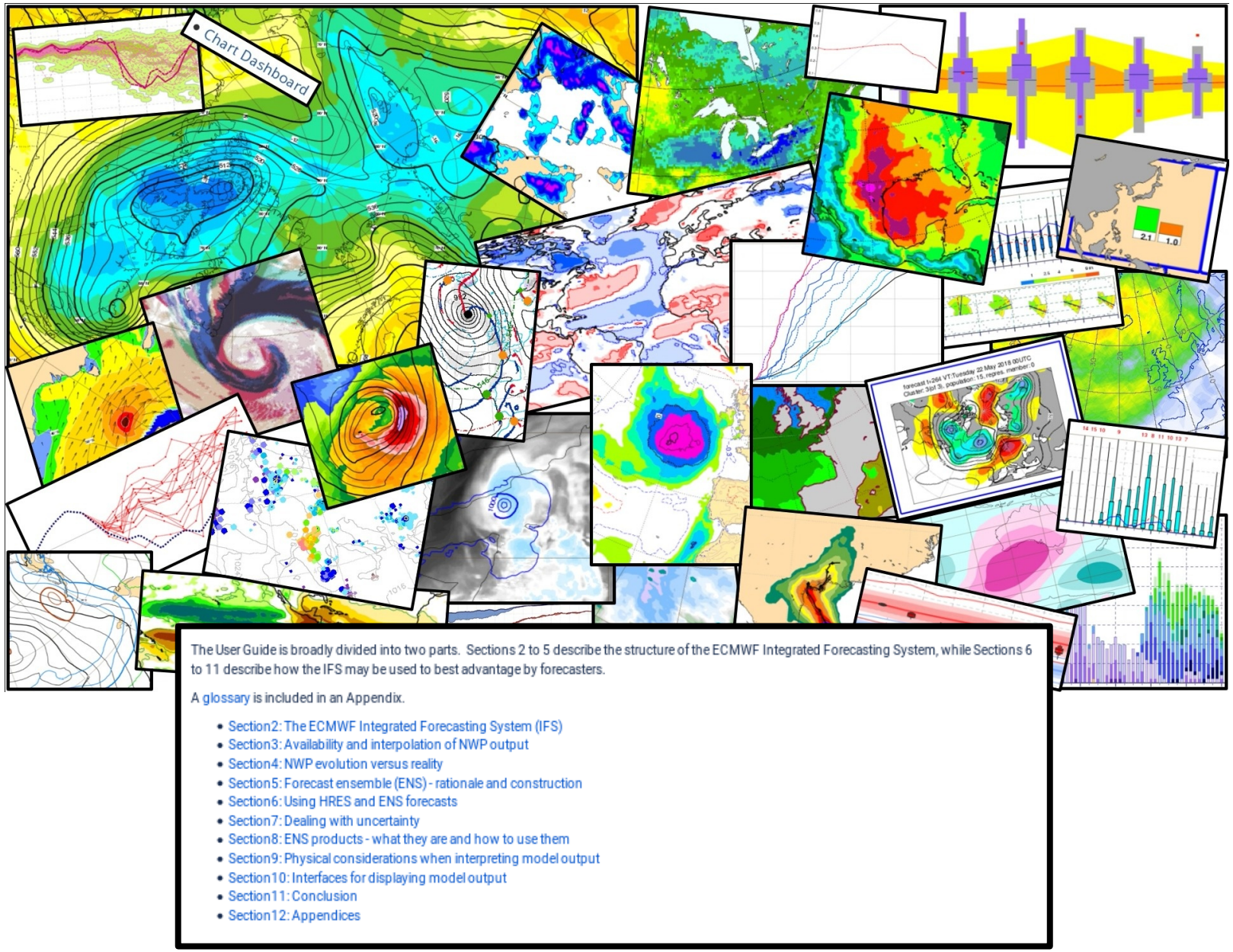


Serving Member and Cooperating States

Collaborations and serving community: WORKSHOPS

- Workshop on shedding light on the greyzone
- Workshop on developing Python frameworks for earth system sciences
- ECMWF/ESA workshop on using low frequency passive microwave measurements in research and operational applications
- Workshop on observations and analysis of sea-surface temperature and sea ice for NWP and climate applications
- Workshop: Hydrological services for business
- Workshop: Radiation in the next generation of weather forecast models
- Workshop on Member and Co-operating State requirements for ECMWF outputs in support of multi-hazard Early Warning Systems
- Using ECMWF's forecasts (UEF2018)
- Hackathon: "Innovate with Open Climate Data"
- Workshop on physics-dynamics coupling 2018 (PDC18)
- Radio-Frequency Interference (RFI) workshop
- Annual Seminar: Earth system assimilation
- 18th Workshop on high performance computing in meteorology





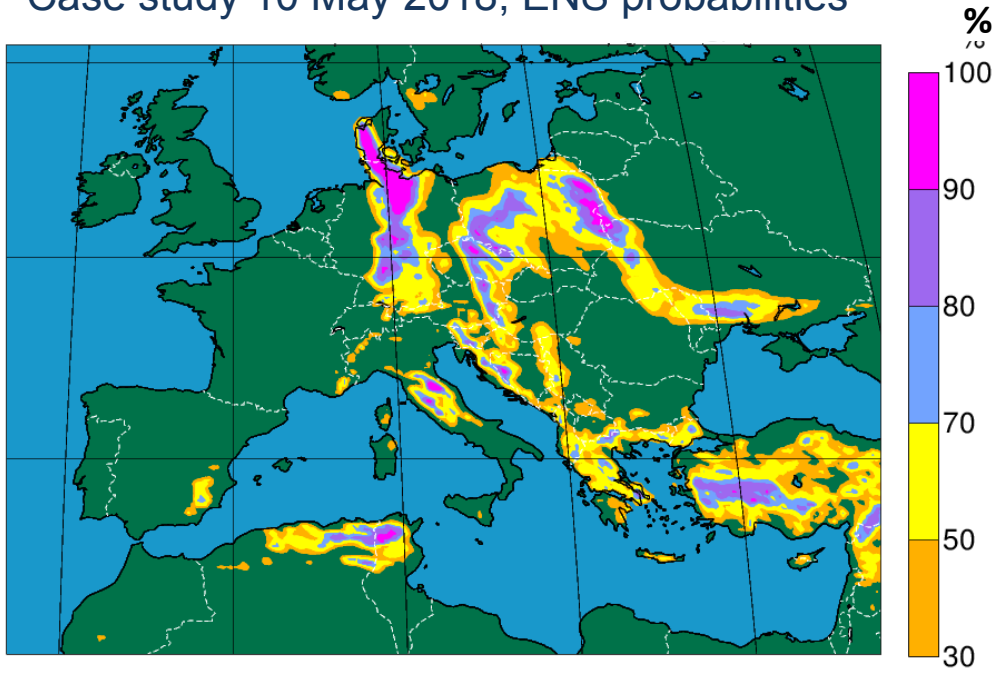
"Forecast User Guide"

- A new a vastly updated web-based version of this document was released to MS/CS and other users in May 2018, in the forecast_user portal
- It provides helpful information, for forecasters in particular, on these and other topics:
  - how the model formulations work (in relatively simple terms)
  - what ECMWF products are and how to make best use of them
  - where and when user expectations, regarding forecast accuracy, can be elevated or lowered
- This is a live document, undergoing frequent updating, as and when models and products change and our understanding of them improves

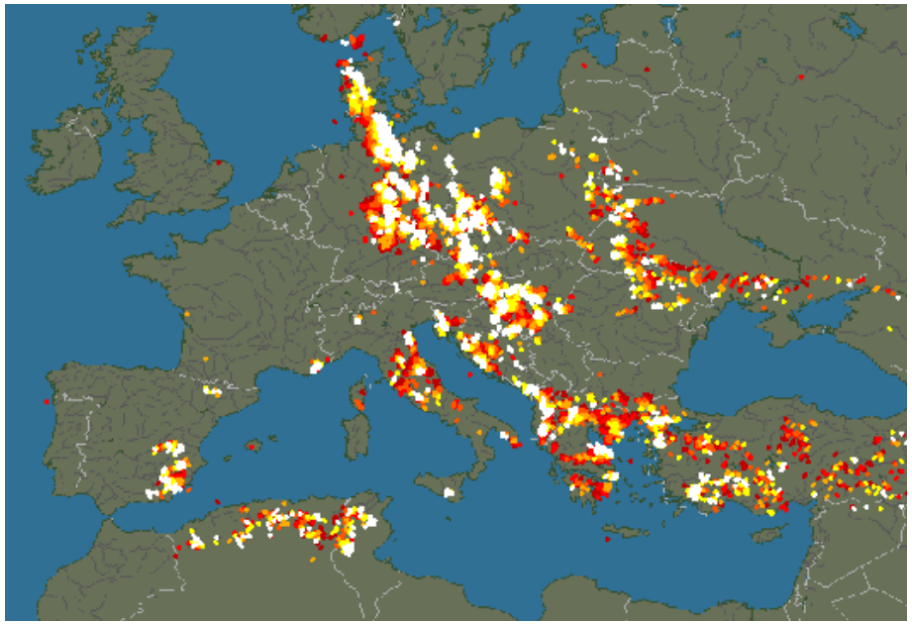
Useful diagnostics of extreme events

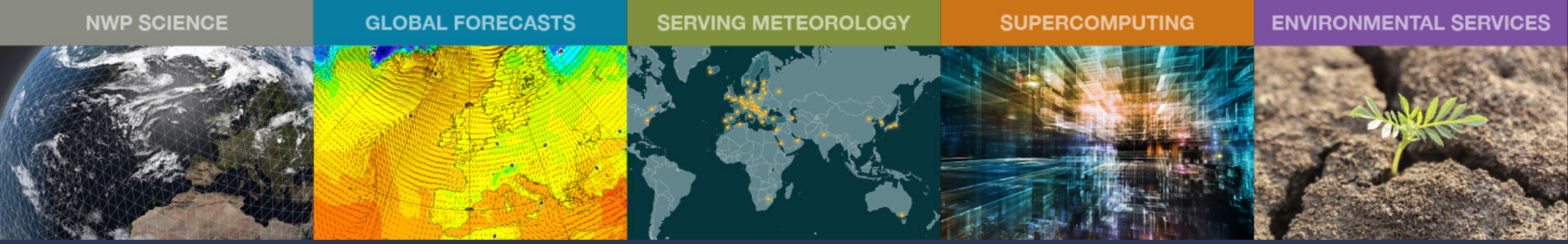
Probability of lightning flash density from ENS

Case study 10 May 2018, ENS probabilities



Observed lightning strikes (Blitzortung.org)



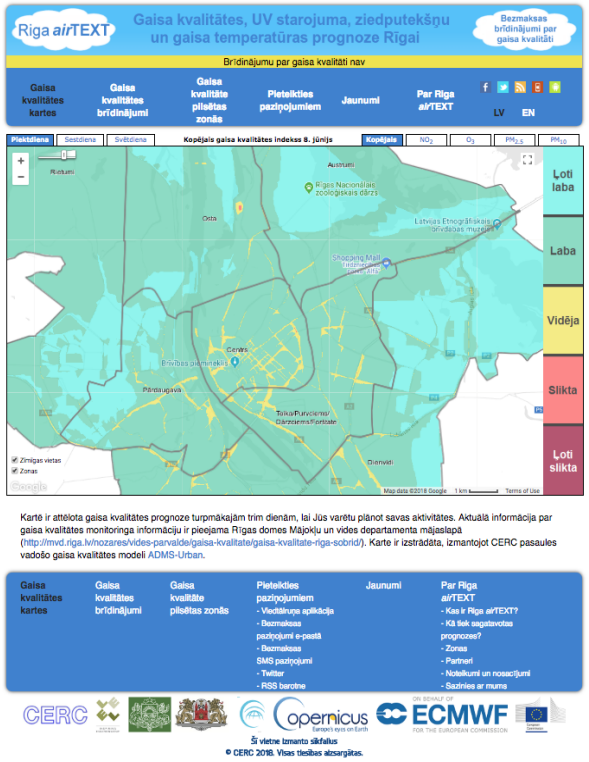


Copernicus @ ECMWF

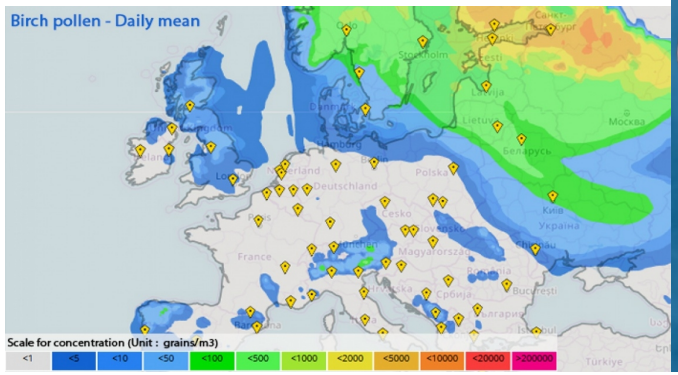
Successful uptake of ECMWF Copernicus products

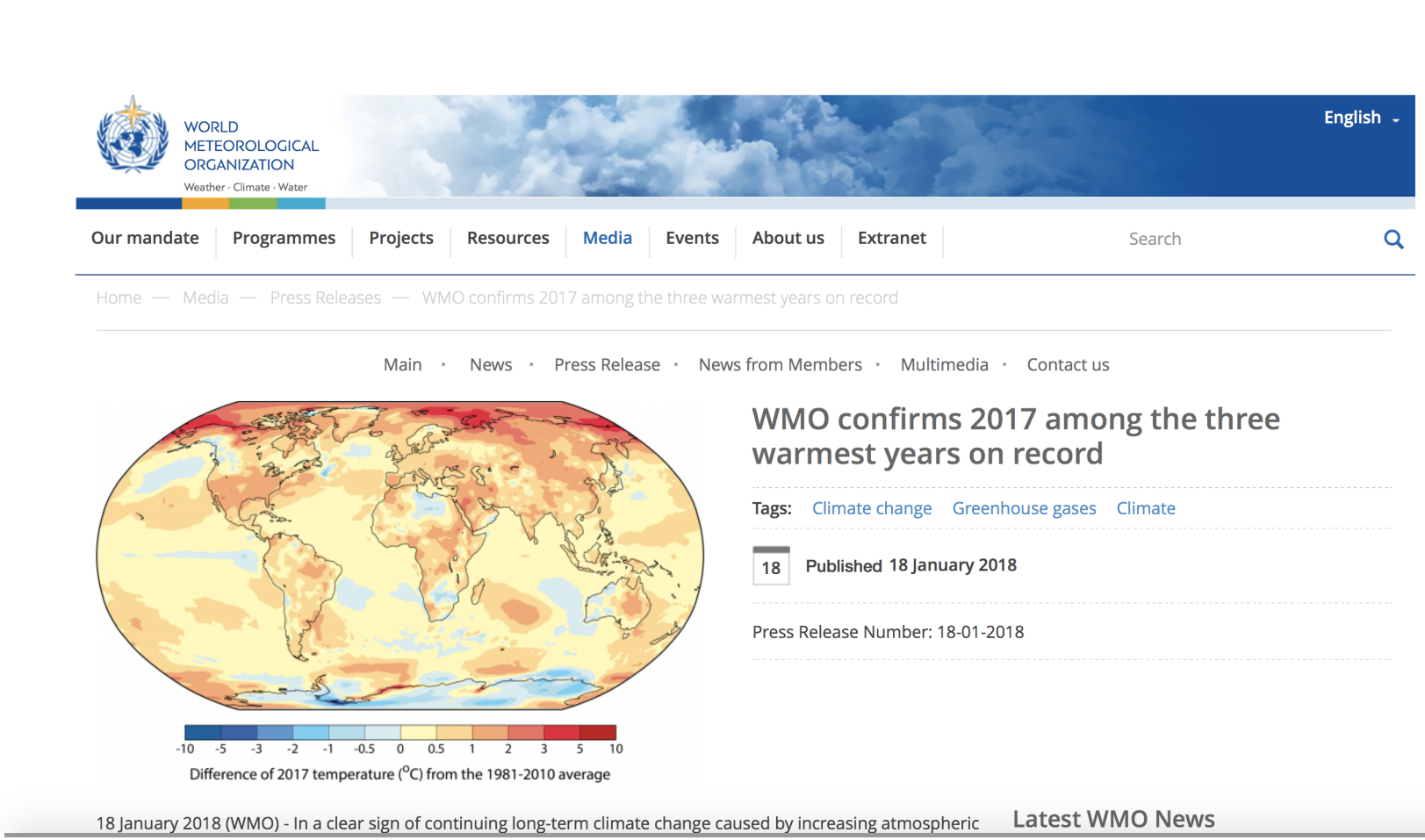
CAMS and C3S **direct users** = a few tens of thousands
…**Actual reach** is much larger!

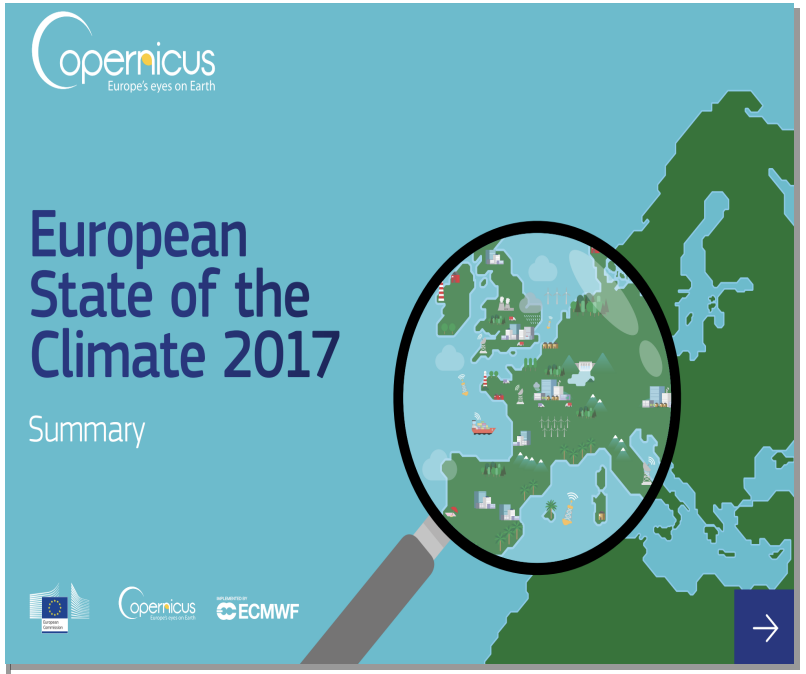
AirText Riga
265000 visits
in first month…



MétéoPollen
10,000 downloads
first month in Apple
appstore.







4 years of development towards a European Climate Service of reference

A one-stop Climate Data Store

We have built a store.

The door opened to customers in June 2018

We continuously put products on the shelves.

Open and freely available data

Climate data records

cds.climate.copernicus.eu

ECMWF contribution to C3S

ERA5 is in production at ECMWF for C3S

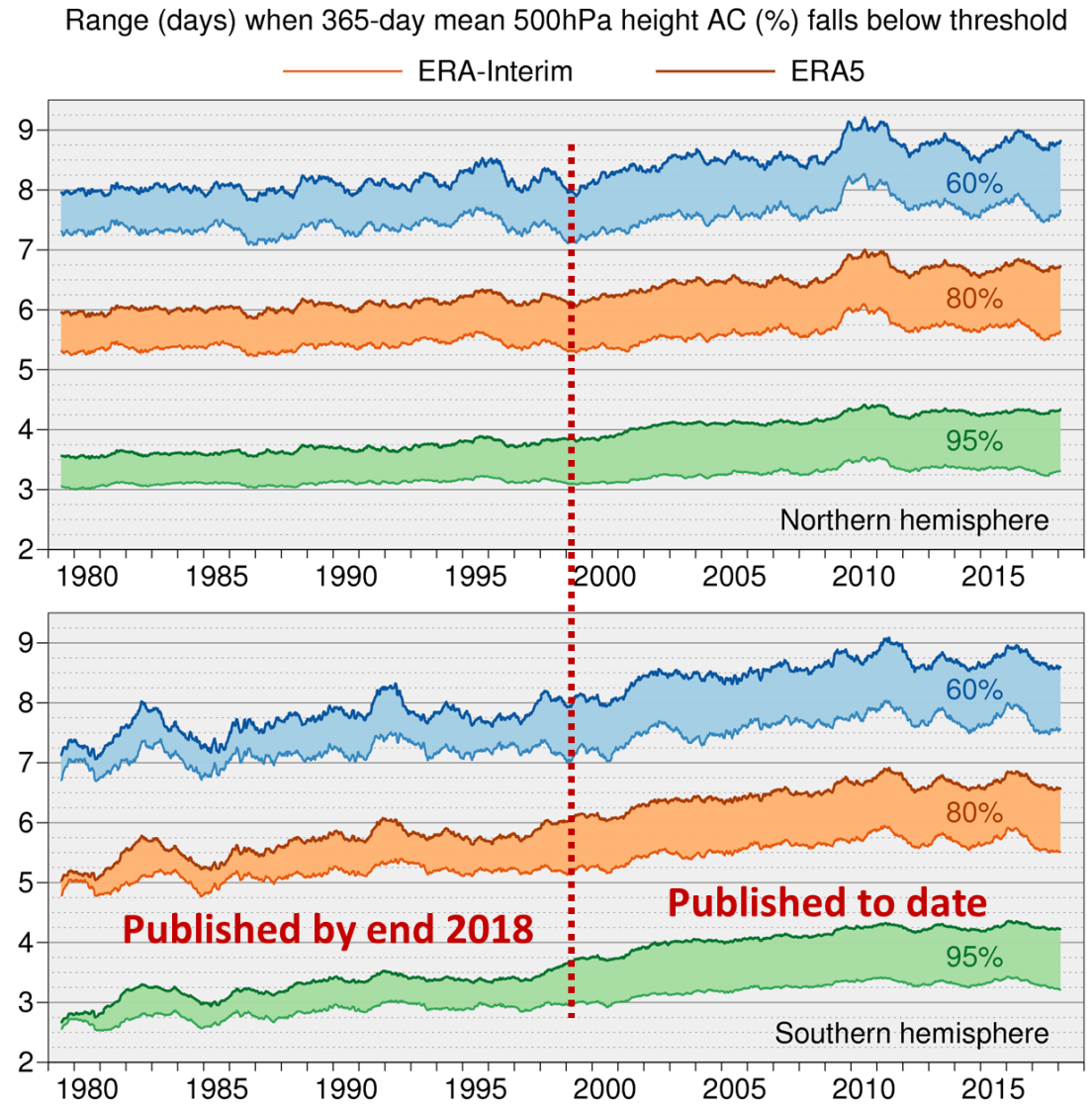
ERA5 will replace ERA-Interim

Improvements compared to ERA-Interim:

- Benefit from 10 years model development
- Much higher resolution; **31km** versus 80km
- More and better input data
- Hourly output
- Uncertainty estimate (at 62km)
- Will reach further back in time (1950 versus 1979)

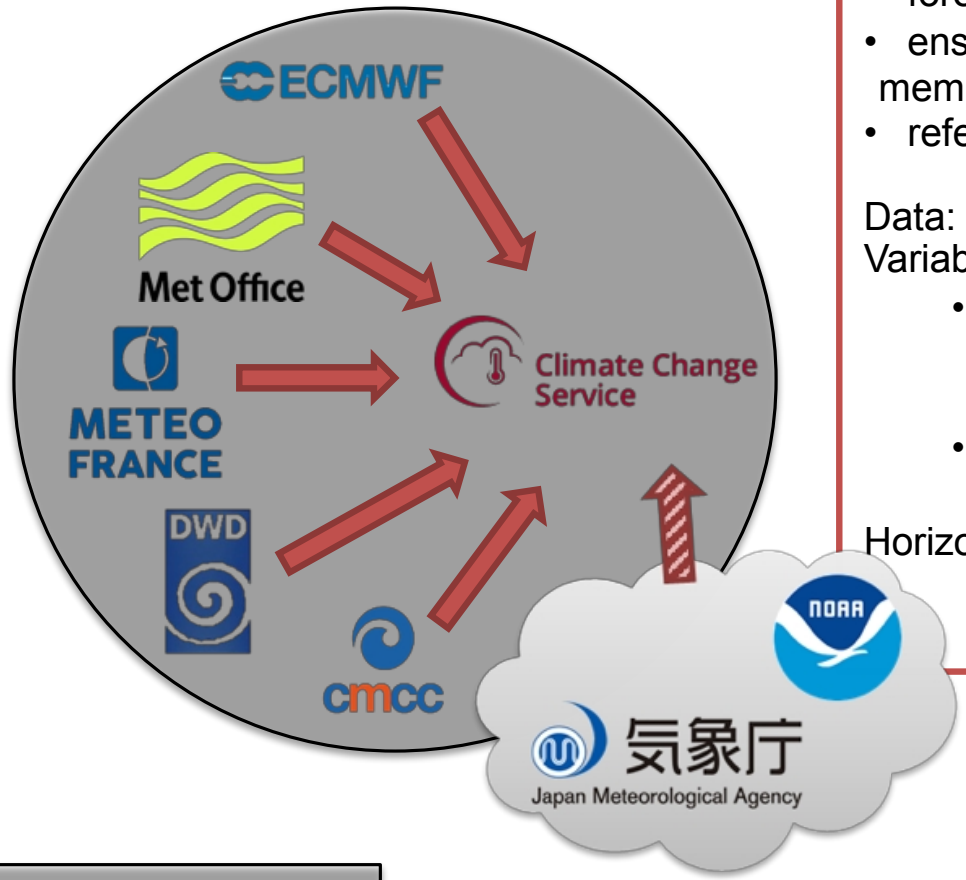
CDS public release plan:

- **Published to date:** 2000–2018,
  updates 2-months behind real time
- **Before end 2018:** 1979 onwards,
  updates 2-5 days behind real time: ERA5T
- **Mid 2019:** 1950-1978.
  Production of ERA-Interim is no longer supported
- **Mid 2019**: Production of ERA5-land (1979 onwards) completed



Forecasts from ERA5 analyses have higher skill than those from ERA-Interim.

ECMWF Contribution to C3S



Protocol:
- time of submission of data; time of publication of forecasts (13th of each month)
- ensemble size (forecasts: ~50 members; hindcasts: ~25 members)
- reference period: 1993-2016 (24 years)

Data:
Variables
- Surface
  - 9 vars every 6h
  - +20 vars every 24h
- Pressure (11 levels, from 925 hPa to 10 hPa)
  - 5 vars every 12 h

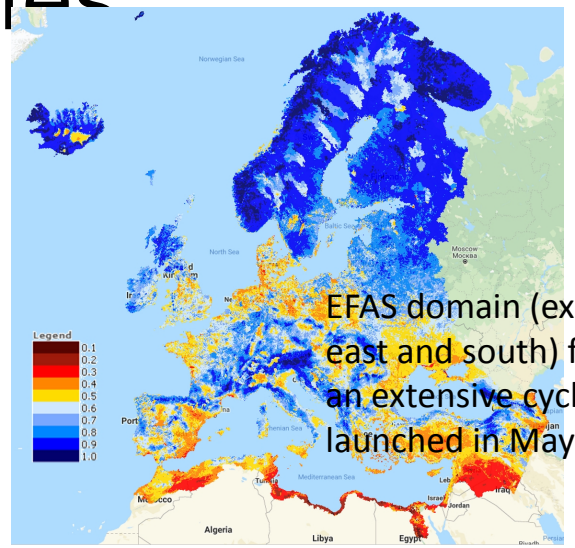
Horizontal grid: global 1deg x 1deg

Agreed netCDF specification C3S-0.1 (based on CF)

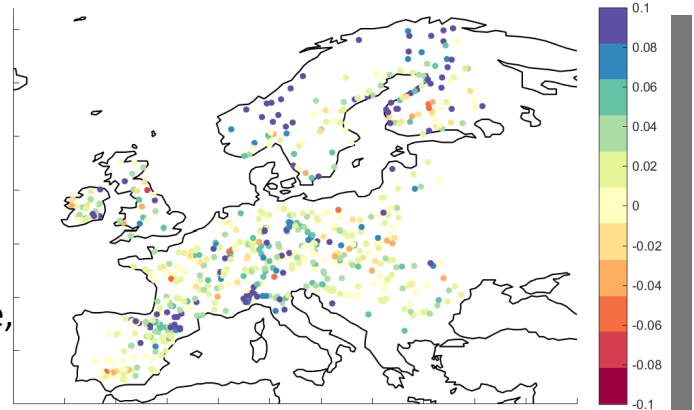
Also likely: ECCC and BoM

Copernicus Emergency Management Services (Floods and Fire) – 2018 activities

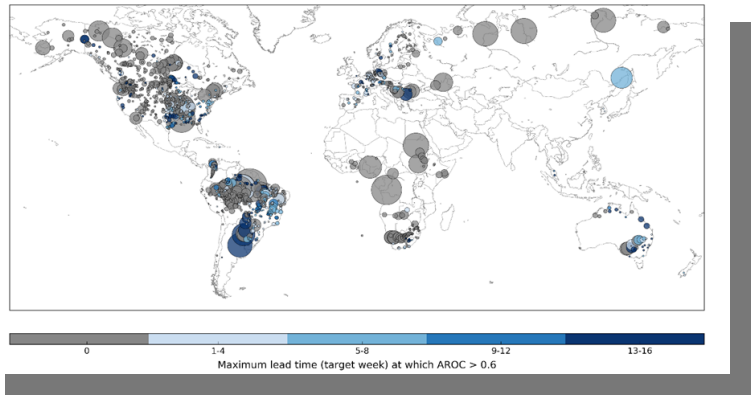
New EFAS web interface extensively tested by users in summer 2018, to be launched Dec 2018



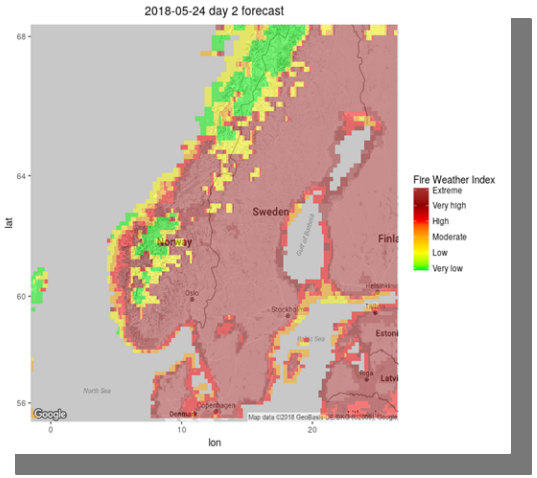
EFAS domain (extended east and south) following an extensive cycle upgrade, launched in May 2018



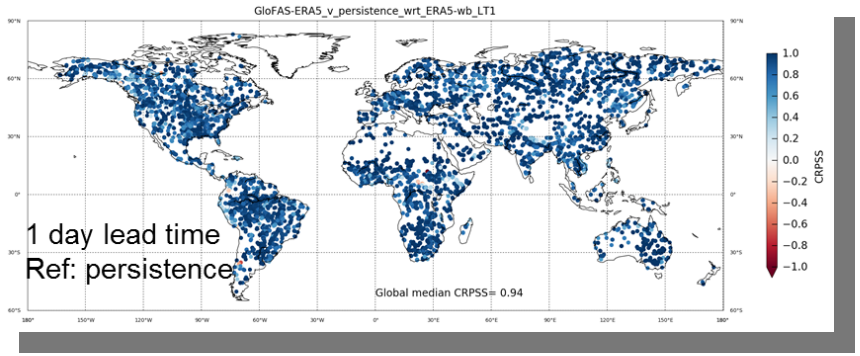
Skill improvement (blue and green) in EFAS summer 2016 hydrological forecasts when using prototype calibrated rainfall forecasts (3-day lead time)



Maximum lead time of skilful high flow forecasts produced by GloFAS Seasonal. Based on SEAS5. Dot size show catchment area. Available as a pre-operational service since Nov 2017



EFFIS Fire Weather Index for the 24 May 2018, 2-day lead time, ran operationally by ECMWF



Skill in GloFASv2.0 cycle hydrological forecasts (1-day lead time) to be launched Nov 2018, following full operationalisation of GloFASv1.0 in May 2018

The strength of a common goal